

# EXHIBIT 1

## Comparative Digestive Physiology

### I. Anatomical classification

#### A. Significance of fermentative digestion

1. All mammals have some fermentative capacity
2. Importance is directly related to fiber consumption

#### B. Pregastric fermentors

1. Importance of domestic ruminants in animal production
2. Other well-known pregastric fermentors include macropod marsupials (e.g. kangaroo), hippopotamus and hamster

#### C. Postgastric fermentors

1. Cecal fermentors
  1. Mainly rodents and other small herbivores
  2. Often associated with coprophagy (feces eating)
2. Colonic fermentors
  1. Includes true herbivores (e.g. horse), omnivores (e.g. pig, human) and carnivores (e.g. cat, dog)
  2. Degree of colonic sacculation is related to importance of fiber digestion and fermentative capacity

**NOTE:** The comparative importance of fermentation as a means of digestion can be related to the fraction of total digesta contained in fermentative compartments of the gastrointestinal tract.

### II. Adaptations to feed sources

#### A. Prehension, mastication, deglutition

1. Prehensile adaptations include forelimb (primates, raccoon), snout (elephant, tapir), tongue (anteater, cow) lips (horse, sheep).
2. Masticatory adaptations include large canines and incisors (carnivores), specialized molars (herbivores), relative toothlessness of edentates (sloths, armadillos).
3. Deglutition (swallowing) varies little with diet but quantity and composition of saliva varies considerably.

#### B. Gastric capacity and structure

1. Capacity is greatest in pregastric fermentors, stomachs act as reservoir
2. Small stomachs in carnivores is related to high nutrient density of the diet
3. Distribution and composition of epithelial lining varies between species and dietary adaptations

#### C. Intestinal length and functions

1. Small intestine
  1. Less variable between species than stomach and hind gut, but generally shorter in carnivores than in herbivores
2. Large intestine
  1. Importance of hind gut fermentation dictates variation in structure and size
  2. Some hind gut fermentation occurs in most species [e.g. dog (carnivore), pig (omnivore) and pony (herbivore)]

### III. Fiber digestion - Ruminants vs Nonruminants

1. In general, pregastric fermentation increases the efficiency of fiber digestion. Larger nonruminants offset their lower digestive efficiency by eating and passing more; smaller nonruminants select more digestible forage components and/or practice coprophagy.